COMMUNICATION   PROTOCOL

VERSION   :   2.13

CHECKED BY   : Robin/Sam Wei

PREPARED BY : Charly

DATE   :   12. 01, 2015

Item	DATA	DESCRIPTION	MODIFY BY
5	2016.10.21	Q5 Description Error. 1. Vb, Vbc unit should be 0.01V on Page5 to Page6.	Robin

4	2016.9.26	1. Q1 Command : I/P fault voltage → Reversed
		2. Q1's Battery voltage become Battery capacity.
		3. #MMM.M QQQ SS.SS RR.R<cr> change to
		   #MMM.M QQQ SSS.S RR.R<cr>
		4. Q1 Flag : Detail description of Shutdown Active
		   Flag.
			Robin.

3	2015.12.01	Added Q5 Command on page 5 to page 6	Sam Wei
2	2010.12.30	Modify Shutdown Command item on page 7	Sam Wei/Robin/Charly
1	2009.05.11	Initial	Robin

Ablerex COMMUNICATION PROTOCOL

A. General: This document specifies the RS232C communication protocol of the Advance-Intelligent UPS. The protocol provided the following features :

    1. Monitor charger status.

    2. Monitor battery status and condition.

    3. Monitor the utility status.

    4. Provide the power switch function for computer to turn on and off the utility on schedule for power saving.

    Computer will control information exchange by a query followed by <cr> .UPS will respond with information followed by a <cr> or action.

B. Hardware:

    BAUD RATE................ : 2400 bps

    DATA LENGTH .... : 8 bits

    STOP BIT .... : 1 bit

    PARITY .... : NONE

CABLING :

```
    COMPUTER                          UPS

    _____
    _____ ~ _____
        RX    < ---------------- TX (pin 2)
        TX        ---------->     RX (pin 3)
        GND   < ------------- GND (pin 5)
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    (9 pins female D-type connector)

C. COMMUNICATION PROTOCOL:

1   Status Inquiry:

        Computer : Q 1 <cr>
       UPS   : UPS status data stream, such as
         (MMM.M NNN.N PPP.P QQQ RR.R S.SS TT.T b7b6b5b4b3b2b1b0<cr>

  UPS status data stream :
      There should be a space character between every field for data separation. The meaning of each field is list as followed:

a.   Start byte: (
b.   I/P voltage: MMM.M
   M is and integer number ranging from 0 to 9.
   The unit is Volt.

c.   I/P fault voltage: NNN.N **(Reversed. Please don't use)**
    N is and integer number ranging from 0 to 9.
    The unit is Volt.

  c.1 ** For OFF-LINE UPS**
    Its purpose is to identify a short duration voltage glitch which cause OFF line UPS to go to Inverter mode. If this occurs input voltage will appear normal at query prior to glitch and will still appear normal at next query.

    The I/P fault voltage will hold glitch voltage till next query. After query, the I/P fault voltage will be same as I/P voltage until next glitch occurs.

  c.2 ** For ON-LINE UPS**
    Its purpose is to identify : a short duration utility fail which cause ON line UPS to go to battery mode. If this occurs input voltage will appear normal at query prior to fail and will still appear normal at next query.
    The I/P fault voltage will hold utility fail voltage till next query. After query, the I/P voltage will be same as I/P voltage until next utility fail occurs.

d.   O/P voltage : PPP.P

   P is an integer number ranging form 0 to 9 .
   The unit is Volt.

e.   O/P load percentage   :QQQ
     QQQ is a load percentage.

f.   I/P frequency : RR.R
     R is an integer number ranging from 0 to 9 .
     The unit is Hz.

g.   Battery Capacity Parameter: SS.S or S.SS
     S is an integer number ranging from 0 to 9.
         For on-line units battery capacity parameter is provided in the form S.SS .
         For off-line units battery capacity parameter is provided in the form SS.S .
         UPS type in UPS status will determine which reading was obtained.
     For Software: How to Calculation battery capacity?
         Step 1: calculate Battery Capacity parameter
                 On-line
                     Battery Capacity parameter = S.SS
                 Off-line
                     Battery Capacity parameter
                             = SS.S / [(F command's Battery voltage) /12].
         Step 2: Please follow the Mapping Table A and B to get battery
                 capacity from Battery Capacity parameter.

h.   Temperature   : TT.T
     T is an integer number ranging form 0 to 9.
     The unit is degree of centigrade.

i.   UPS Status   :<U>
     <U> is one byte of binary information such as
     <b7b6b5b4b3b2b1b0>.
     Where bn is a ASCII character '0' or' 1 '.

   UPS status :

        Bit   Description
        7   1 : Utility Fail (Immediate)
        6   1 : Battery Low
        5   1 : Bypass **(on-line)**/Boost or Buck Active **(off-line)**
        4   1 : Battery abnormal
        3   1 : UPS Type is off-line **("1" is off-line, "0" is On-line)**
        2   1 : Test in Progress
        1   1 : Shutdown Active
        0   1 : Beeper On

Detail description of the Shutdown Active Flag:

      Shutdown Active flag (bit 1) should be active/enabled only at shutdown process. It means: flag will enable when UPS is counting for shutting down, after that it should be disabled.

    j.   Stop Byte : <cr>

Example: Computer: Q 1 <cr>
        UPS   :
        (208.4 140.0 208.4 034 59.9 2.05 35.0 00110000<cr>

    Means: I/P voltage is 208.4V.
              I/P fault voltage is 140.0V.
              O/P voltage is 208.4V.
              O/P load percentage is 34 %.
              I/P frequency is 59.9 HZ.
              Battery capacity parameter is 2.05.
              Temperature is 35.0 degrees of centigrade.
              UPS type is on-line, Battery abnormal. Bypass
              active, and shutdown not active.

2   Q5(0x0d):   Extra power parameters Information

PC→ UPS

Size (byte)	2	1
Field Definition	Head	End
ASCII	Q5	(0x0d)

UPS → PC

Size (byte)	1	2	2	2	2	2	2	2	2	2	2	1
Field Definition	Head	fout	Rev	Rev	Vb (Each)	Vbc (Each)	InvW	ErCode	O_Cur	Rev	Rev	End
ASCII	(	Binary Unit:0.1	Binary Unit:N/A	Binary Unit:N/A	Binary Unit:0.01	Binary Unit:0.01	Binary Unit:1	Binary Unit:N/A	Binary Unit:0.1	Binary Unit:N/A	Binary Unit:N/A	(0x0d)

Fout → High byte + Low byte

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Note:

column	Explanation	Unit
Fout	UPS output frequency	0.1 Hz
Vb	Battery voltage per one battery	0.01 V
Vbc	UPS of Battery Cut per one battery	0.01 V
InvW	Watt of UPS output	1 W
ErCode	Error Code of UPS	N/A
O_Cur	Load Current of UPS	0.1 A

Example: Computer: Q 5 <cr>
        UPS   : (0258 0000 0000 04B0 03E8 07D0 000C 000A 0000 0000 <cr>

    Means: Fout is 60.0V.
            Vb is 12.00V.
            Battery Cut per one battery is 10.00V.
            Watt is 2000W.
            Error Code is Er12.
            Load Curren is 1.0A.

3   Test for 10 seconds:

        Computer   : T <cr>
        UPS   : Test for 10 seconds and return to utility.

        If battery low occur during testing, UPS will return to
        utility immediately.

4   Test until battery low:

        Computer   : TL<cr>
        UPS   : Test until battery low and return to utility.

5   Test for specified time period :

        Computer   : T <n><cr>
        UPS   : Test for <n> minutes.
        a. During testing, UPS returns to utility immediately, if
            battery low occur.
        b. <n> is a number ranging from 01 to 99.

6   Turn On/Off beep --Toggle the UPS beeper : (Default : beep on)

        Computer   : Q<cr>

a.   OFF-line UPS :
        UPS alarm can be turned on or turned off by sending this command
        if AC power failed and battery energy is higher than low battery
        level.

b.   On-line UPS:
        UPS alarm can be turned on or turned off by sending this command
        if UPS occurred a alarm condition.

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7   Shutdown Command :

        Computer   : S<n><cr>
        UPS   : Shut UPS output off in <n> minutes.

a.   The UPS output will be off after <n> minutes, even if the utility power
     is present or not. After then, if Utility power was removed, UPS will
     completely shutdown.
b.   The UPS will be auto restart if UPS was completely shutdown and then awaked
     by utility.
c.   <n> is a number ranging form .2, .3. ..., 01,02, ..., up to 10.

        For example : S.3<cr> ---shut output off in (.3) minutes

8   Shutdown and Restore Command :

        Computer   : S<n> R <m><cr>
        UPS   : Shut UPS output off in <n> minutes, and waiting
                     for <m> minutes then turn on UPS output again.

a.   The shutdown sequence is the same as the previous command.
b.   If UPS is in restore waiting state:
     b.1 The UPS will be completely shutdown if the utility was removed and
          battery low occurred. After then, UPS will be auto restart if the
          utility restore.
c.   If the <m> minute is time out and utility is present but abnormal
     c.1 The UPS will wait to restart until utility back to normal.
     c.2 The UPS will be completely shutdown if the utility was removed.
     c.3 After step c.2, the UPS will be auto restart once utility restore.
d.   <n> is a number ranging form .2, .3, 01, 02. ..., up to 10.
e.   <m> is a number ranging form 0001 to 9999.

9   Cancel Shutdown Command :

        Computer   : C<cr>
        UPS   : Cancel the S<n><cr> and S<n>R<m><cr> command
                   Turn on UPS from standby mode.

a.   If UPS is in shut down waiting state (still in countdown situation), the
     shut down command will be cancelled.
b.   The UPS will be turn on except for UPS occurred error or UPS is completely
     off.

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10 Cancel Test Command :

       Computer   : CT <cr>
       UPS   : Cancel all test activity and back to previously condition
                 immediately.

11 UPS Information Command:

       Computer   : I <cr>
       UPS   : #Company_ Name UPS_Model Version<cr>

       This function will make the UPS respond with the basic information
       about the company who manufacture the UPS, the model name of the UPS
       and the version number of the UPS firmware. The length of every field
       is listed as follows:
Company-Name: 15 characters, leave space if less than 15 characters
UPS Model   : 10 characters, leave space if less than 10 characters
Version   : 10 characters, leave space if less than 10 characters

       There should be a space character between every field for separation.

12 UPS Rating Information:

       Computer   : F <cr>
       UPS   : #MMM.M QQQ SS.SS RR.R<cr>

    This function makes the UPS answer the rating value of UPS. There should be
    a space character between every field for separation. The UPS's response
    contains the following information field:

       a. Output Rating Voltage : MMM.M
       b. Output Rating Current : QQQ
       c. Battery Voltage   : SSS.S
       d. Output Rating Frequency: RR.R

D. COMMAND SUMMARY:

ITEM	COMMAND	DESCRIPTION
1	Q1	Status Inquiry
2	T	10 Seconds Test
3	TL	Test until Battery Low
4	T<n>	Test for Specified Time Period
5	Q	Turn On/Off beep
6	S<n>	Shut Down Command
7	S<n>R<m>	Shut Down and Restore Command
8	C	Cancel Shut Down Command
9	CT	Cancel Test Command
10	I	UPS Information Command
11	F	UPS Rating Information
12	Q5	Extra power parameters Information

Table A: On line Battery Capacity mapping table

On-line Battery Capacity parameter	Battery Capacity
2.22	100%
2.21	90%
2.20	88%
2.19	87%
2.18	85%
2.17	83%
2.16	82%
2.15	80%
2.14	78%
2.13	77%
2.12	75%
2.11	73%
2.10	72%
2.09	70%
2.08	68%
2.07	65%
2.06	65%
2.05	62%
2.04	62%
2.03	58%
2.02	58%
2.01	55%
2.00	55%
1.99	53%
1.98	52%
1.97	50%
1.96	48%
1.95	47%
1.94	45%
1.93	43%
1.92	42%
1.91	40%
1.90	38%
1.89	37%
1.88	35%
1.87	33%
1.86	32%
1.85	30%
1.84	28%

1.83	27%
1.82	25%
1.81	23%
1.80	22%
1.79	20%
1.78	18%
1.77	17%
1.76	15%
1.75	13%
1.74	12%
1.73	10%
1.72	8%
1.71	7%
1.70	5%
1.69	3%
1.68	2%
1.67	0%

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Table B: Off line Battery Capacity mapping table

Off-line Battery Capacity parameter	Battery Capacity
13.5	100%
13.3	90%
13.2	88%
13.1	86%
13	83%
12.9	80%
12.8	77%
12.7	74%
12.6	72%
12.5	69%
12.4	66%
12.3	63%
12.2	61%
12.1	58%
12	55%
11.9	52%
11.8	49%
11.7	47%
11.6	44%
11.5	41%
11.4	38%
11.3	36%
11.2	33%
11.1	30%
11	27%
10.9	24%
10.8	22%
10.7	19%
10.6	16%
10.5	13%
10.4	11%
10.3	8%
10.2	5%
10.1	2%
10	0%